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John Snow and the Broad Street Pump: 150 Years of Epidemiology

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The handle of the Broad Street pump is a symbol that is revered in public health; it marks the coming together of the science of epidemiology and the practice of prevention. For public health professionals, events surrounding the removal of the pump handle hold lessons that still guide practice.

In 1854, London was experiencing one of the most vicious of several recent epidemics of cholera; some 500 people contracted and died of the disease within the first ten days. Most of them lived within an area of several city blocks in the Soho district of London near Golden Square.

On September 7, 1854, John Snow, a London anesthesiologist and nearby resident, appeared before the local governing body. He argued that the source of the epidemic was the water from a communal pump that provided drinking water for the neighborhood. His investigation pointed to the pump on Broad Street near its intersection with Cambridge Street. What ensued is best told in his own words: "I had an interview with the Board of Guardians of St. James's parish on the evening of Thursday, 7th September, and represented the above circumstances to them. In consequence of what I said, the handle of the pump was removed on the following day."[1]

This year is the 150th anniversary of that memorable action.

The site where the Broad Street pump stood in Snow's time does not appear in most popular London tourist guides, but it is marked for its historical significance in several ways. The site can be identified by comparing a current map of Soho with one of the celebrated maps (Figure 1) produced by Snow to document his investigations.[2] Neither street forming the intersection retains the name it held in 1854 – Broad Street has become Broadwick Street and Cambridge Street has become Lexington Street. However, the intersection retains its characteristic shape and its relationship to other major roads, such as Regent Street and Oxford Street. On the corner itself is the John Snow pub, renamed at the time of the 100th anniversary observance in 1955.

Some 20 feet down the Broadwick Street side of the pub a wall plaque marks the actual site of the pump, now long removed. And on the corner diagonally opposite the pub is a replica of the pump with an explanatory marker at its base, both placed there in 1992.

All of the authors visited the site during the past few months. We noted the irony that the replica was encircled by an excavation site for repairs to the local water system. The accompanying photograph[2] (Figure 2) shows the commemorative pump, pre-construction, with the John Snow pub in the background.

The history of John Snow and the Broad Street pump holds several lessons for those of us who apply epidemiologic results to public health today.

For example, epidemiologic studies can identify successful prevention strategies even in the absence of knowledge of the biological mechanisms of disease. Although Snow believed that the disease was spread from one victim to the next via fecal-oral transmission, with water being a route for transmission across households, he did not have any specific information or theory as to how this occurred. Not until 30 years later did scientists identify the cholera organism (*vibrio cholerae*) or how the disease was transmitted.

To be effective, epidemiologic findings must receive immediate attention, often before complete information is available. The first case of cholera in the outbreak associated with the Broad Street pump is believed to have occurred on August 29. Snow presented his findings to the Board of Guardians only nine days later. Authorities removed the pump handle the next day. Even this brief lag between findings and action produced dire consequences; by the time the handle was removed the number of fatal cholera cases per day had fallen from over 142 on September 1 to 14 on September 8. Furthermore, Snow investigated only 83 of the ultimate 616 cholera deaths linked to the water from the Broad Street pump.[1] He continued his investigation in the months after the end of the epidemic.

Epidemiologic investigation and interpretations build on experience. Snow's action during the epidemic in Golden Square

Figure 1. *Excerpt of John Snow's spot map of the 1854 cholera epidemic in London.*

Figure 2. *Replica of the Broad Street pump and John Snow pub (background), London.*

benefited from his investigation of two previous cholera outbreaks in south London in 1849. Those observations strongly suggested a water-borne method of transmission.[3] When the geographically localized outbreak near Golden Square occurred, Snow recognized that the pattern was consistent with contamination of a single point source, not an entire water system serving multiple pumps.[1] His earlier work prepared him for a rapid, focused investigation of the Golden Square outbreak and led to his proposal to remove the pump handle.

Geography is an important consideration in epidemiology, and not just in environmental epidemiology. The essence of Snow's evidence implicating the Broad Street pump was the geographic pattern of the residences of the victims, most of whom lived closer to that pump than to other pumps in the area. Where there were exceptions, he investigated and explained that some victims only worked or went to school near the pump but didn't live there. Others simply preferred the Broad Street pump water to water from pumps nearer their residences.

However, Snow did not use his celebrated spot maps in his presentation to the Board of Guardians; they first appeared in a report he produced in late 1854.[3] There they were used to support his conclusion regarding the water-based transmission of cholera for broader audiences, including physicians and scientists.

Finally, scientific conclusions may not be immediately accepted, even when supported by clear evidence. After considering both Snow's evidence and competing views, "the Committee on Scientific Inquiries of the General Board of Health flatly rejected the pump theory and insisted that some concentrated noxious atmospheric influence, no doubt emanating from putrefying organic matter, was the cause of the Golden Square outbreak."[4] Ironically, the health authorities of the time did not recognize this event as pivotal. From the vantage point of 150 years later, we find it hard to accept that John Snow's views, so respected today, were not met with immediate and unanimous agreement in his own time. However, as his experience demonstrates, decisions using scientific evidence are never completely independent of the social, economic and political context in which they take place.

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References

1. Snow J. On the mode of communication of cholera. London: John Churchill, 1855 (2nd ed.).
2. http://www.ph.ucla.edu/epi/snow.html
3. Epidemiological Society. Lancet 1854; ii:531.
4. Brody H, Russell Rip M, Vinten-Johansen P, et al. Map-making and myth-making in Broad Street: the London cholera epidemic, 1854. Lancet 2000; 356:64-8.

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